

# BLF881; BLF881S

UHF power LDMOS transistor

Rev. 4 — 1 September 2015

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

A 140 W LDMOS RF power transistor for broadcast transmitter applications and industrial applications. The transistor can deliver 140 W from HF to 1 GHz. The excellent ruggedness and broadband performance of this device makes it ideal for digital transmitter applications.

**Table 1. Typical performance**

RF performance at  $V_{DS} = 50$  V in a common-source 860 MHz test circuit.

| Mode of operation | f<br>(MHz)                  | $P_L$<br>(W) | $P_{L(PEP)}$<br>(W) | $P_{L(AV)}$<br>(W) | $G_p$<br>(dB) | $\eta_D$<br>(%) | IMD3<br>(dBc) | IMD <sub>shldr</sub><br>(dBc) |
|-------------------|-----------------------------|--------------|---------------------|--------------------|---------------|-----------------|---------------|-------------------------------|
| 2-tone, class AB  | $f_1 = 860$ ; $f_2 = 860.1$ | -            | 140                 | -                  | 21            | 49              | -34           | -                             |
| DVB-T (8k OFDM)   | 858                         | -            | -                   | 33                 | 21            | 34              | -             | -33 <sup>[1]</sup>            |

[1] Measured [dBc] with delta marker at 4.3 MHz from center frequency.

#### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

### 1.2 Features and benefits

- 2-Tone performance at 860 MHz, a drain-source voltage  $V_{DS}$  of 50 V and a quiescent drain current  $I_{Dq} = 0.5$  A:
  - ◆ Peak envelope power load power = 140 W
  - ◆ Power gain = 21 dB
  - ◆ Drain efficiency = 49 %
  - ◆ Third order intermodulation distortion = -34 dBc
- DVB performance at 858 MHz, a drain-source voltage  $V_{DS}$  of 50 V and a quiescent drain current  $I_{Dq} = 0.5$  A:
  - ◆ Average output power = 33 W
  - ◆ Power gain = 21 dB
  - ◆ Drain efficiency = 34 %
  - ◆ Shoulder distance = -33 dBc (4.3 MHz from center frequency)
- Integrated ESD protection
- Excellent ruggedness
- High power gain

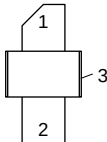
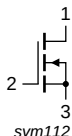
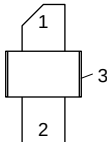
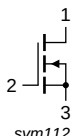
- High efficiency
- Excellent reliability
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

- Communication transmitter applications in the UHF band
- Industrial applications in the UHF band

## 2. Pinning information

Table 2. Pinning

| Pin               | Description | Simplified outline                                                                    | Graphic symbol                                                                        |
|-------------------|-------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| BLF881 (SOT467C)  |             |                                                                                       |                                                                                       |
| 1                 | drain       |  |   |
| 2                 | gate        |                                                                                       |                                                                                       |
| 3                 | source      |                                                                                       |                                                                                       |
| BLF881S (SOT467B) |             |                                                                                       |                                                                                       |
| 1                 | drain       |  |  |
| 2                 | gate        |                                                                                       |                                                                                       |
| 3                 | source      |                                                                                       |                                                                                       |

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                                           |         |
|-------------|---------|-----------------------------------------------------------|---------|
|             | Name    | Description                                               | Version |
| BLF881      | -       | flanged LDMOST ceramic package; 2 mounting holes; 2 leads | SOT467C |
| BLF881S     | -       | earless LDMOST ceramic package; 2 leads                   | SOT467B |

## 4. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter            | Conditions | Min  | Max  | Unit |
|-----------|----------------------|------------|------|------|------|
| $V_{DS}$  | drain-source voltage |            | -    | 104  | V    |
| $V_{GS}$  | gate-source voltage  |            | -0.5 | +13  | V    |
| $T_{stg}$ | storage temperature  |            | -65  | +150 | °C   |
| $T_j$     | junction temperature |            | -    | 200  | °C   |

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol        | Parameter                                | Conditions                                               | Typ | Unit     |
|---------------|------------------------------------------|----------------------------------------------------------|-----|----------|
| $R_{th(j-c)}$ | thermal resistance from junction to case | $T_{case} = 80\text{ °C}$ ;<br>$P_{L(AV)} = 70\text{ W}$ | [1] | 0.95 K/W |

[1]  $R_{th(j-c)}$  is measured under RF conditions.

## 6. Characteristics

**Table 6. DC characteristics**

$T_j = 25\text{ °C}$  unless otherwise specified.

| Symbol        | Parameter                        | Conditions                                                          | Min | Typ  | Max | Unit |
|---------------|----------------------------------|---------------------------------------------------------------------|-----|------|-----|------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage   | $V_{GS} = 0\text{ V}$ ; $I_D = 1.35\text{ mA}$                      | [1] | 104  | -   | V    |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10\text{ V}$ ; $I_D = 135\text{ mA}$                      | [1] | 1.4  | -   | V    |
| $I_{DSS}$     | drain leakage current            | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$                      | -   | -    | 1.4 | μA   |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GSth} + 3.75\text{ V}$ ; $V_{DS} = 10\text{ V}$        | 19  | 21   | -   | A    |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 10\text{ V}$ ; $V_{DS} = 0\text{ V}$                      | -   | -    | 140 | nA   |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GSth} + 3.75\text{ V}$ ; $I_D = 4.5\text{ A}$          | [1] | -    | 210 | mΩ   |
| $C_{iss}$     | input capacitance                | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$ | -   | 100  | -   | pF   |
| $C_{oss}$     | output capacitance               | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$ | -   | 33.5 | -   | pF   |
| $C_{rss}$     | reverse transfer capacitance     | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 50\text{ V}$ ; $f = 1\text{ MHz}$ | -   | 1    | -   | pF   |

[1]  $I_D$  is the drain current.

**Table 7. RF characteristics**

$T_h = 25\text{ °C}$  unless otherwise specified.

| Symbol                  | Parameter                              | Conditions | Min | Typ | Max | Unit |
|-------------------------|----------------------------------------|------------|-----|-----|-----|------|
| <b>2-Tone, class AB</b> |                                        |            |     |     |     |      |
| $V_{DS}$                | drain-source voltage                   |            | -   | 50  | -   | V    |
| $I_{Dq}$                | quiescent drain current                |            | -   | 0.5 | -   | A    |
| $P_{L(PEP)}$            | peak envelope power load power         |            | -   | 140 | -   | W    |
| $G_p$                   | power gain                             |            | 20  | 21  | -   | dB   |
| $\eta_D$                | drain efficiency                       |            | 45  | 49  | -   | %    |
| IMD3                    | third-order intermodulation distortion |            | -   | -34 | -30 | dBc  |

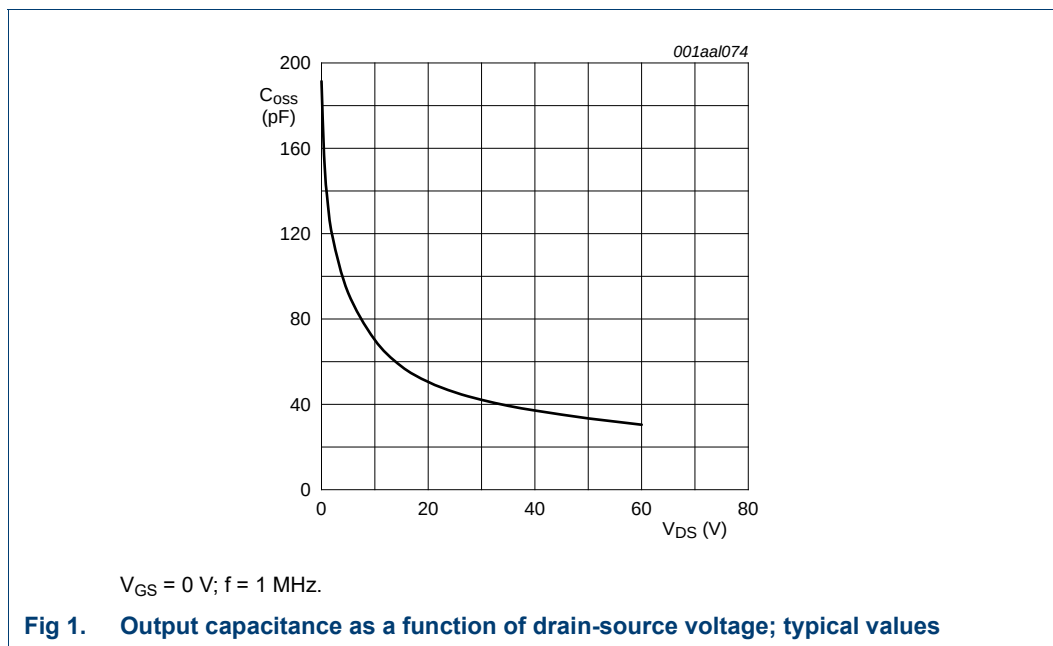
**Table 7. RF characteristics ...continued**

$T_h = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol                 | Parameter                           | Conditions | Min | Typ | Max | Unit |
|------------------------|-------------------------------------|------------|-----|-----|-----|------|
| <b>DVB-T (8k OFDM)</b> |                                     |            |     |     |     |      |
| $V_{DS}$               | drain-source voltage                |            | -   | 50  | -   | V    |
| $I_{DQ}$               | quiescent drain current             |            | -   | 0.5 | -   | A    |
| $P_{L(AV)}$            | average output power                |            | -   | 33  | -   | W    |
| $G_p$                  | power gain                          |            | 20  | 21  | -   | dB   |
| $\eta_D$               | drain efficiency                    |            | 30  | 34  | -   | %    |
| $IMD_{shldr}$          | intermodulation distortion shoulder | [1]        | -   | -33 | -30 | dBc  |
| PAR                    | peak-to-average ratio               | [2]        | -   | 8.3 | -   | dB   |

[1] Measured [dBc] with delta marker at 4.3 MHz from center frequency.

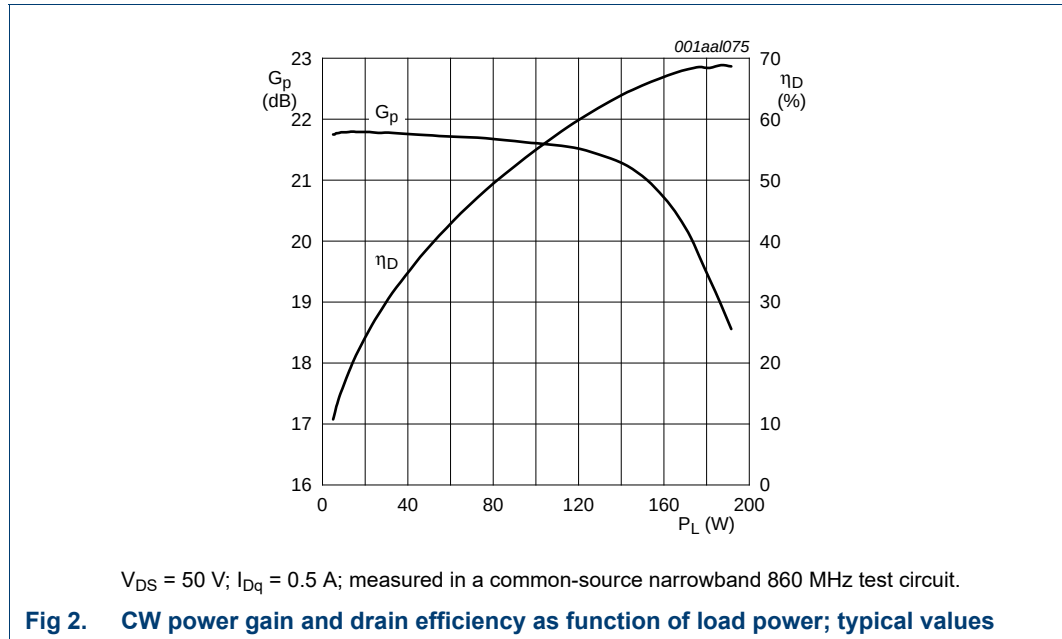
[2] PAR (of output signal) at 0.01 % probability on CCDF; PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.



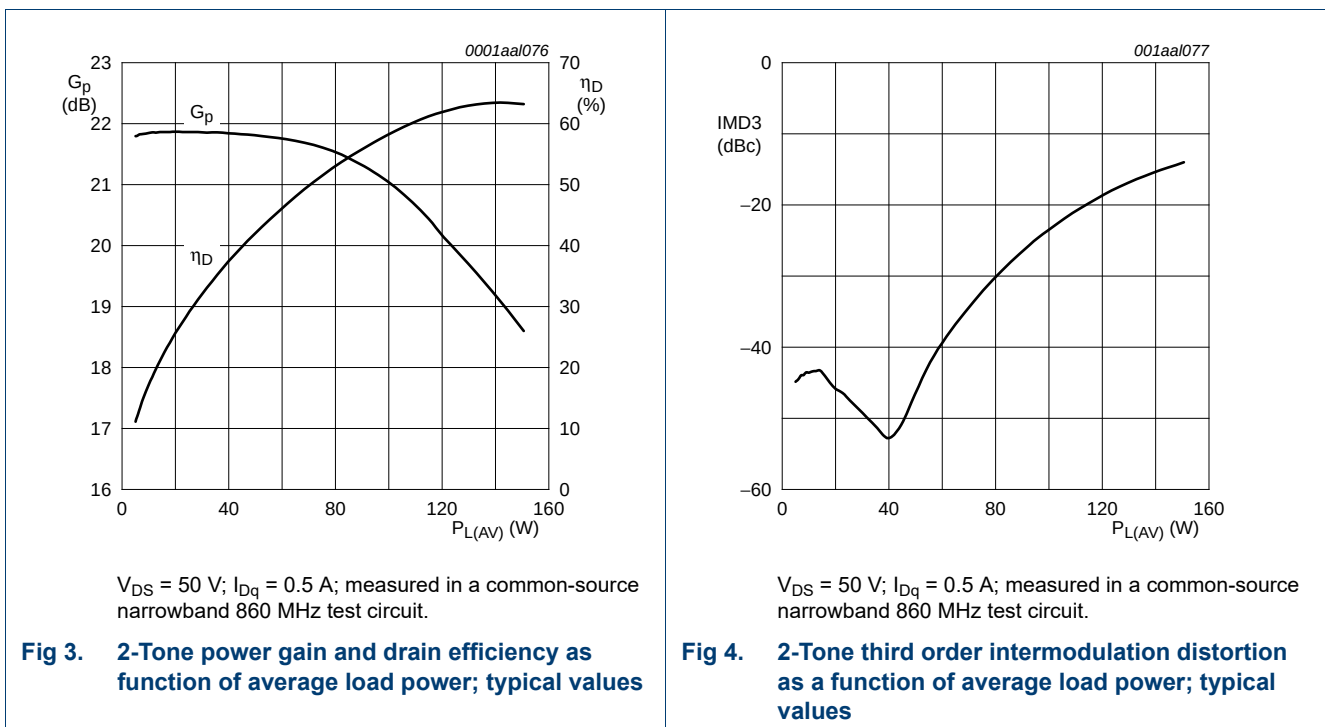
## 7. Application information

### 7.1 Narrowband RF figures

#### 7.1.1 CW



#### 7.1.2 2-Tone



7.1.3 DVB-T

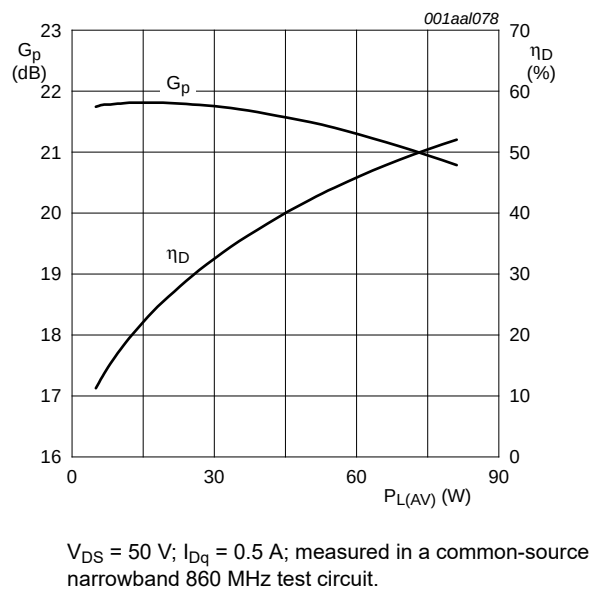


Fig 5. DVB-T power gain and drain efficiency as function of average load power; typical values

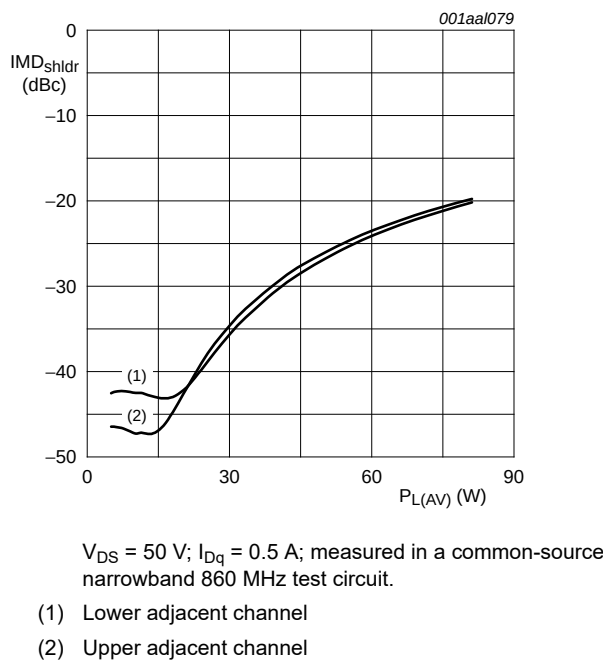
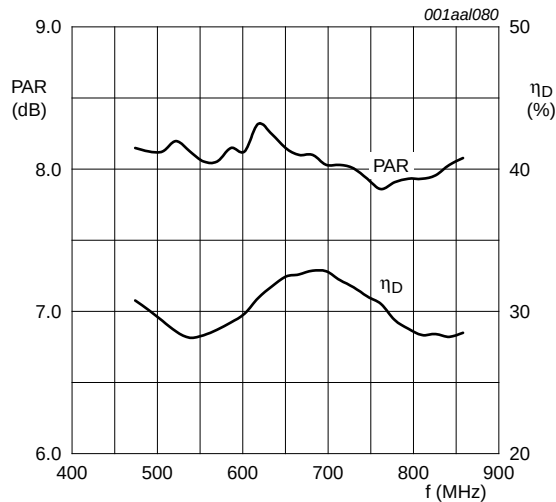


Fig 6. DVB-T shoulder distance as a function of average load power; typical values

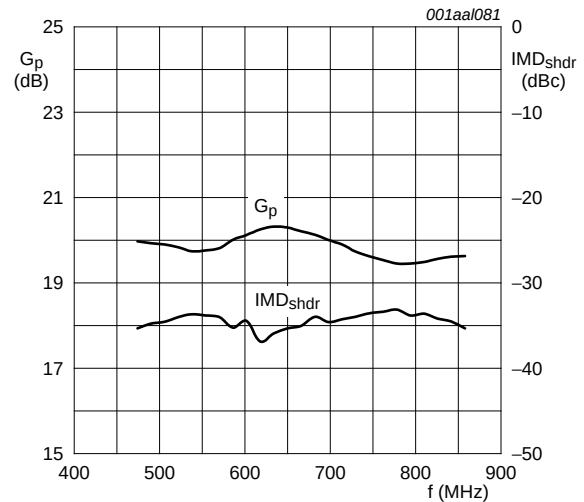
## 7.2 Broadband RF figures

### 7.2.1 DVB-T



$V_{DS} = 50$  V;  $I_{DQ} = 0.35$  A;  $P_{L(AV)} = 33$  W; measured in a common-source broadband test circuit as described in [Section 8](#).

**Fig 7. DVB-T PAR at 0.01 % probability on the CCDF and drain efficiency as function of frequency; typical values**



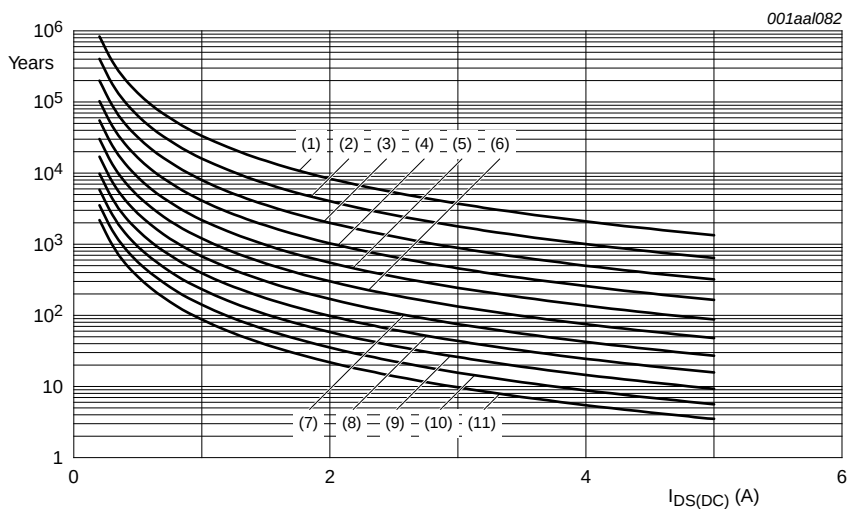
$V_{DS} = 50$  V;  $I_{DQ} = 0.35$  A;  $P_{L(AV)} = 33$  W; measured in a common-source broadband test circuit as described in [Section 8](#).

**Fig 8. DVB-T power gain and shoulder distance as function of frequency; typical values**

## 7.3 Ruggedness in class-AB operation

The BLF881 and BLF881S are capable of withstanding a load mismatch corresponding to  $VSWR = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 50$  V;  $f = 860$  MHz at rated power. Ruggedness is measured in the application circuit as described in [Section 8](#).

## 7.4 Reliability



TTF (0.1 % failure fraction).

The reliability at pulsed conditions can be calculated as follows:  $TTF (0.1 \%) \times 1 / \delta$ .

- (1)  $T_j = 100 \text{ }^{\circ}\text{C}$
- (2)  $T_j = 110 \text{ }^{\circ}\text{C}$
- (3)  $T_j = 120 \text{ }^{\circ}\text{C}$
- (4)  $T_j = 130 \text{ }^{\circ}\text{C}$
- (5)  $T_j = 140 \text{ }^{\circ}\text{C}$
- (6)  $T_j = 150 \text{ }^{\circ}\text{C}$
- (7)  $T_j = 160 \text{ }^{\circ}\text{C}$
- (8)  $T_j = 170 \text{ }^{\circ}\text{C}$
- (9)  $T_j = 180 \text{ }^{\circ}\text{C}$
- (10)  $T_j = 190 \text{ }^{\circ}\text{C}$
- (11)  $T_j = 200 \text{ }^{\circ}\text{C}$

**Fig 9. BLF881 electromigration**



## 8. Test information

**Table 8. List of components**

For test circuit, see [Figure 10](#), [Figure 11](#) and [Figure 12](#).

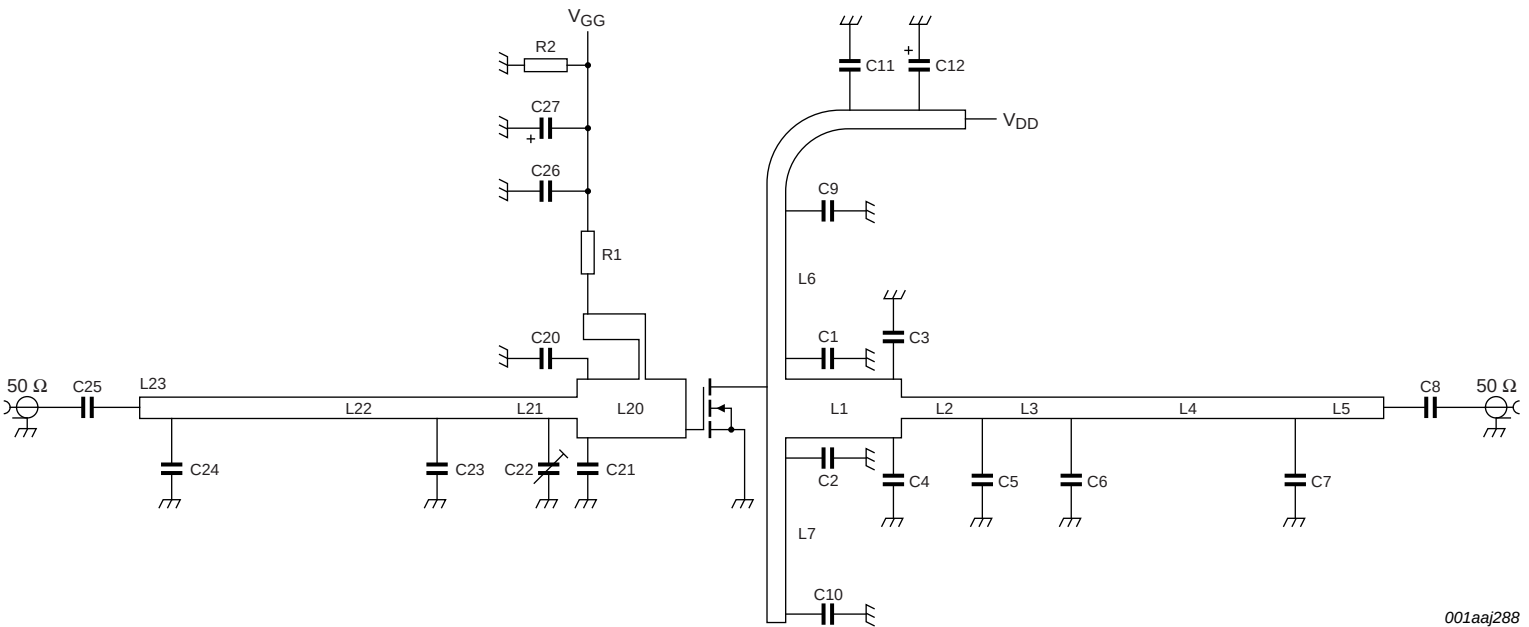
| Component             | Description                       | Value             | Remarks                                              |
|-----------------------|-----------------------------------|-------------------|------------------------------------------------------|
| C1, C2                | multilayer ceramic chip capacitor | 5.1 pF            | [1]                                                  |
| C3, C4                | multilayer ceramic chip capacitor | 10 pF             | [2]                                                  |
| C5                    | multilayer ceramic chip capacitor | 6.8 pF            | [1]                                                  |
| C6                    | multilayer ceramic chip capacitor | 4.7 pF            | [1]                                                  |
| C7                    | multilayer ceramic chip capacitor | 2.7 pF            | [1]                                                  |
| C8, C9, C10, C25, C26 | multilayer ceramic chip capacitor | 100 pF            | [1]                                                  |
| C11, C27              | multilayer ceramic chip capacitor | 10 $\mu$ F        | TDK C570X7R1H106KT000N or capacitor of same quality. |
| C12                   | electrolytic capacitor            | 470 $\mu$ F; 63 V |                                                      |
| C20                   | multilayer ceramic chip capacitor | 10 pF             | [3]                                                  |
| C21                   | multilayer ceramic chip capacitor | 8.2 pF            | [3]                                                  |
| C22                   | trimmer                           | 0.6 pF to 4.5 pF  | Tekelec                                              |
| C23                   | multilayer ceramic chip capacitor | 6.8 pF            | [3]                                                  |
| C24                   | multilayer ceramic chip capacitor | 3.9 pF            | [3]                                                  |
| L1                    | stripline                         | -                 | [4] (W $\times$ L) 7 mm $\times$ 15 mm               |
| L2                    | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 9 mm              |
| L3                    | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 10 mm             |
| L4                    | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 25 mm             |
| L5                    | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 10 mm             |
| L6                    | stripline                         | -                 | [4] (W $\times$ L) 2.0 mm $\times$ 20 mm             |
| L7                    | stripline                         | -                 | [4] (W $\times$ L) 2.0 mm $\times$ 21 mm             |
| L20                   | stripline                         | -                 | [4] (W $\times$ L) 7 mm $\times$ 12 mm               |
| L21                   | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 13 mm             |
| L22                   | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 31 mm             |
| L23                   | stripline                         | -                 | [4] (W $\times$ L) 2.4 mm $\times$ 5 mm              |
| R1                    | resistor                          | 100 $\Omega$      |                                                      |
| R2                    | resistor                          | 10 k $\Omega$     |                                                      |

[1] American technical ceramics type 100B or capacitor of same quality.

[2] American technical ceramics type 180R or capacitor of same quality.

[3] American technical ceramics type 100A or capacitor of same quality.

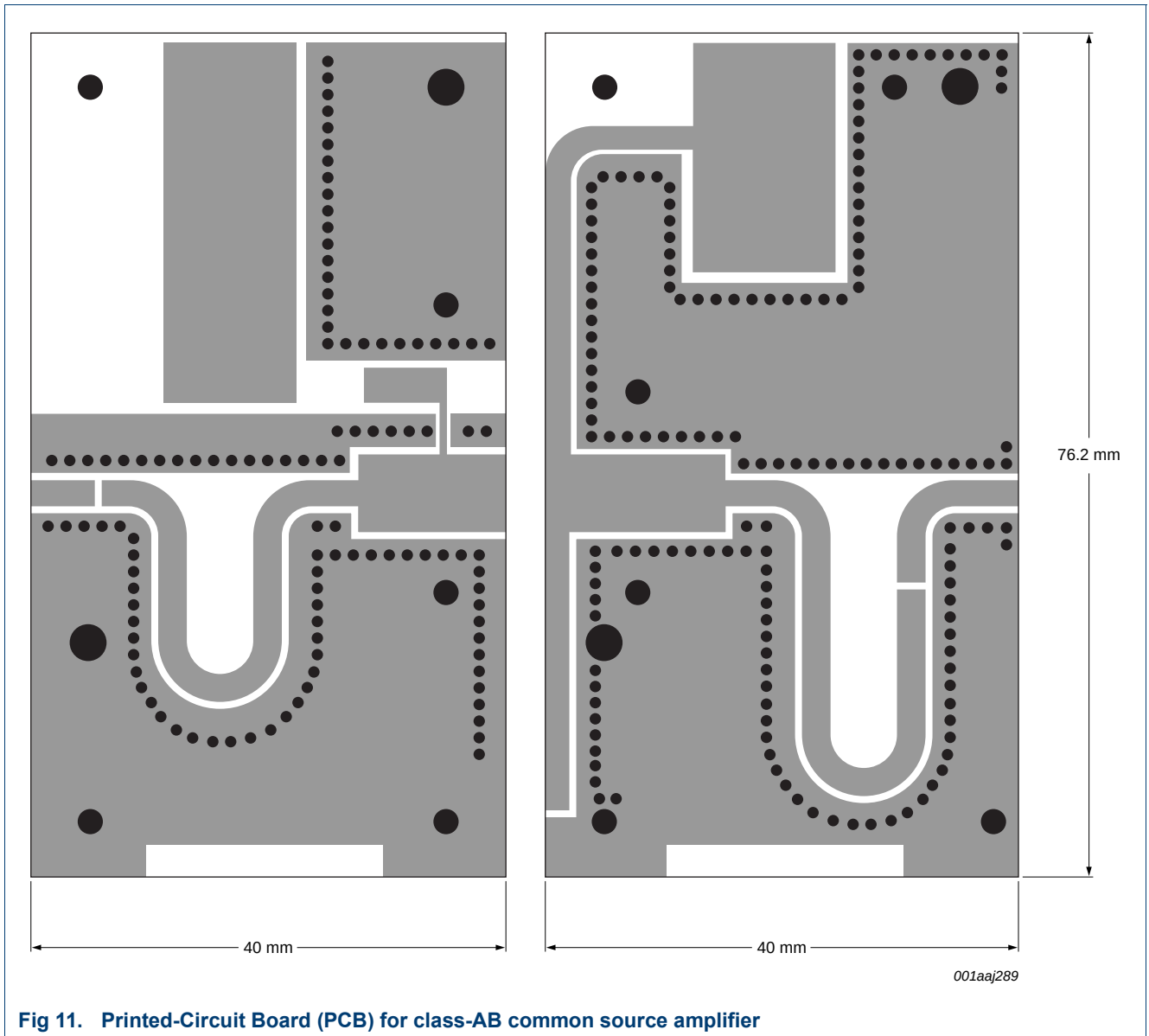
[4] Printed-Circuit Board (PCB): Rogers 5880;  $\epsilon_r = 2.2$  F/m; height = 0.79 mm; Cu (top/bottom metallization); thickness copper plating = 35  $\mu$ m.

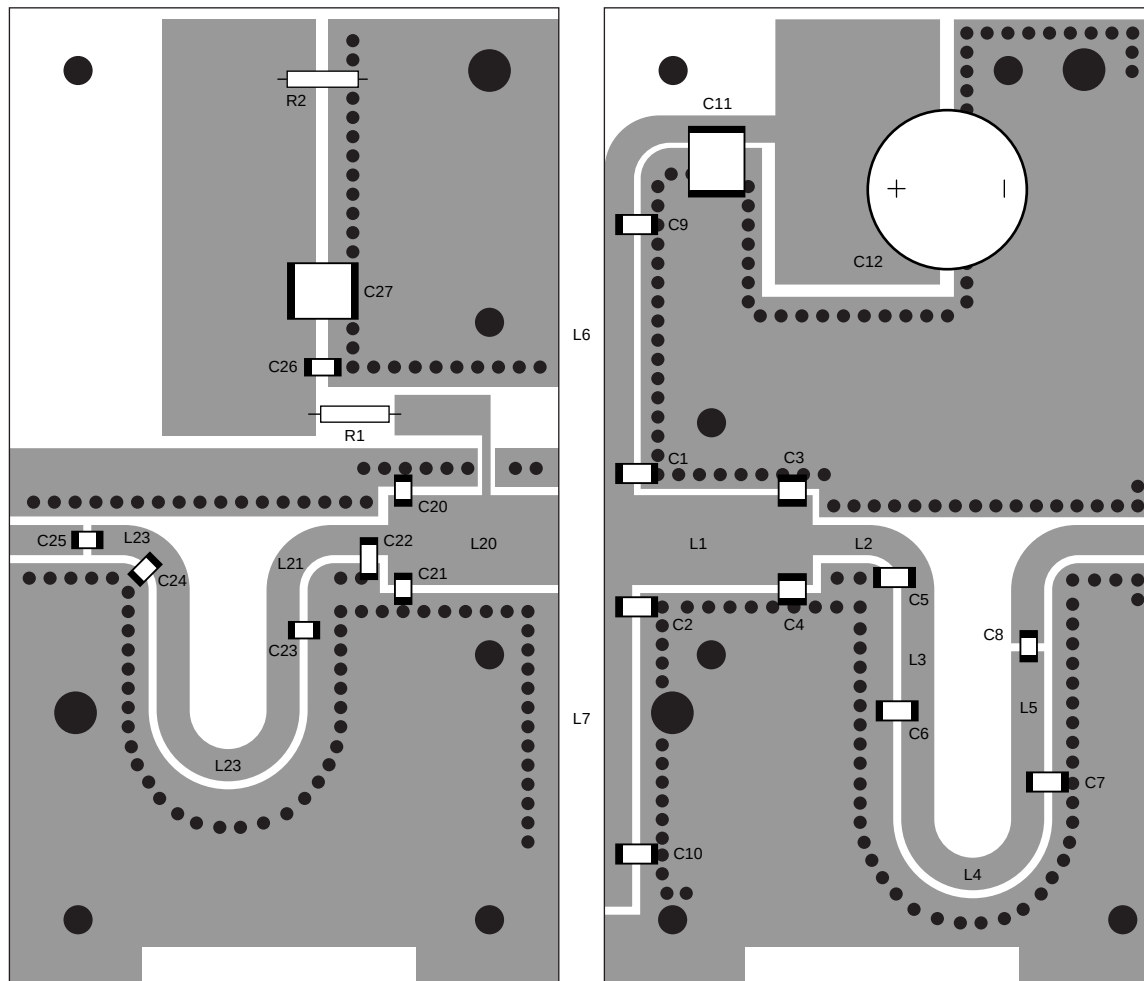


001aaj288

See [Table 8](#) for a list of components.

**Fig 10. Class-AB common-source broadband amplifier**





001aaj290

See [Table 8](#) for a list of components.

**Fig 12. Component layout for class-AB common source amplifier**

## 9. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads

SOT467C

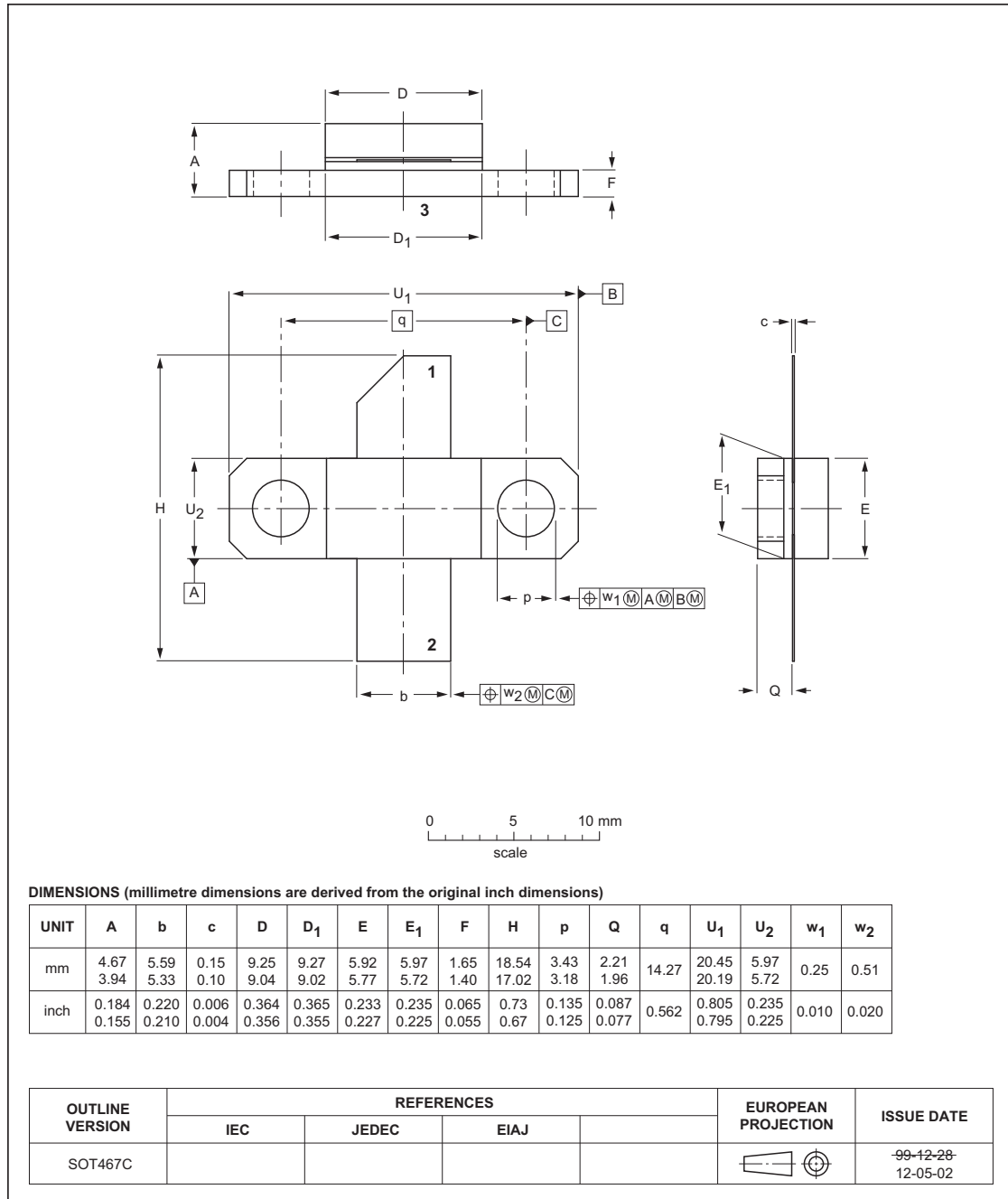


Fig 13. Package outline SOT467C

Earless ceramic package; 2 leads

SOT467B

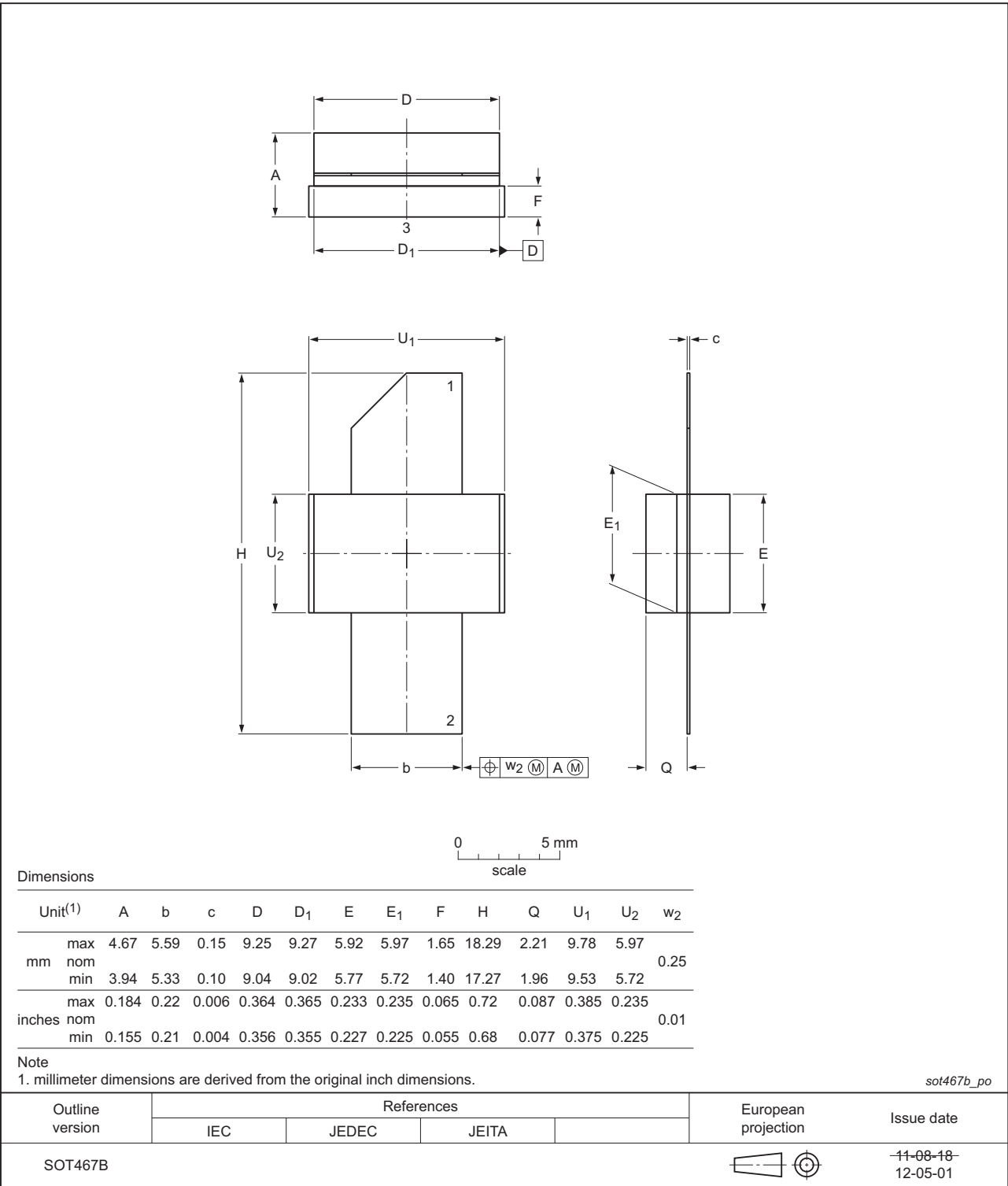


Fig 14. Package outline SOT467B

## 10. Abbreviations

Table 9. Abbreviations

| Acronym | Description                                             |
|---------|---------------------------------------------------------|
| CW      | Continuous Wave                                         |
| CCDF    | Complementary Cumulative Distribution Function          |
| DVB     | Digital Video Broadcast                                 |
| DVB-T   | Digital Video Broadcast - Terrestrial                   |
| ESD     | ElectroStatic Discharge                                 |
| HF      | High Frequency                                          |
| IMD3    | Third order InterModulation Distortion                  |
| LDMOS   | Laterally Diffused Metal-Oxide Semiconductor            |
| LDMOST  | Laterally Diffused Metal-Oxide Semiconductor Transistor |
| OFDM    | Orthogonal Frequency Division Multiplexing              |
| PAR     | Peak-to-Average power Ratio                             |
| PEP     | Peak Envelope Power                                     |
| RF      | Radio Frequency                                         |
| TTF     | Time To Failure                                         |
| UHF     | Ultra High Frequency                                    |
| VSWR    | Voltage Standing-Wave Ratio                             |

## 11. Revision history

Table 10. Revision history

| Document ID        | Release date                                                                                                                                                                                                                               | Data sheet status      | Change notice | Supersedes         |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|--------------------|
| BLF881_BLF881S#4   | 20150901                                                                                                                                                                                                                                   | Product data sheet     | -             | BLF881_BLF881S v.3 |
| Modifications:     | <ul style="list-style-type: none"> <li>The format of this document has been redesigned to comply with the new identity guidelines of Ampleon.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul> |                        |               |                    |
| BLF881_BLF881S v.3 | 20101207                                                                                                                                                                                                                                   | Product data sheet     | -             | BLF881_BLF881S v.2 |
| BLF881_BLF881S v.2 | 20100210                                                                                                                                                                                                                                   | Product data sheet     | -             | BLF881_BLF881S v.1 |
| BLF881_BLF881S v.1 | 20091210                                                                                                                                                                                                                                   | Preliminary data sheet | -             | -                  |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.ampleon.com>.

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Date of release: 1 September 2015  
Document identifier: BLF881\_BLF881S#4